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AUTHOR Hartman, William T.
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ABSTRACT

The potential national costs of implementing federally mandated special education services are discussed in this paper. A resource-cost model is utilized, in which student characteristics and program configurations form the basis for estimating the costs of special education. The procedures require specification of the student population to be served; description of the instructional programs and services to be offered and the resources that comprise each program; and determination of the cost of each resource, the distribution of students across the programs, and the student/personnel ratios of the programs. The paper describes a study in which detailed student and program specifications from 28 states and national sources were obtained to identify the variables that have the largest impact on costs and to show the effects of uncertainty associated with each variable. (Author/JEH)

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PROJECTING SPECIAL EDUCATION COSTS

William T. Hartman*

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*At the time this paper was prepared, William Hartman was a Research Associate at IFG; he is presently an Associate Professor, Division of Educational Policy and Management, College of Education, University of Oregon.

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Abstract

In the past decade state and federal legislation has established mandates requiring that all handicapped children receive an education comensurate with their needs. The potential national costs of implementing these mandates are developed in this paper. The cost estimates are developed using a resource-cost model in which the student characteristics and program configurations form the basis for estimating the costs of special education. The procedures require specification of the student population to be served, description of the instructional programs and services to be offered and the resources which comprise each program (e.g., teacher, aide, materials and supplies, travel allowance, classroom operating and maintenance expense), a price for each resource, determination of the distribution of students across the various programs and services, and the student/personnel ratios of the programs.

Data to operate the resource-cost model were obtained from detailed student and program specifications from 28 states and from national sources. Values representing most likely, low, and high estimates were established for each of the model's variables. The results of the model's calculations indicated a most likely estimate of the costs to serve all school age handicapped students in 1980-81 of $9.0 billion with a range running from $7.3 billion to $12.4 billion. To show the effects of the uncertainty associated with each variable in the model, a series of sensitivity analyses were performed; these indicated that the variable with the largest impact on costs was the assumed incidence rate of handicapping conditions, second were the student/teacher ratios, and following in importance were personnel salaries, placement patterns of students in instructional programs, use of instructional aides, and the inflation rate.

The paper concludes with a discussion of policy uses of the results of the study (e.g., level of funding required to meet legislature mandates and sources of that funding, cost impact of variables under control or influence of policy makers) and the policy uses of the resource-cost model methodology (e.g., cost estimation, simulation of costs of proposed changes in legislation).

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Estimation of the national costs of educating handicapped children is a difficult and uncertain process. To begin, definitions of the eligible populations are not consistent among states. Differences in state laws and regulations include the handicapping conditions to be served, the specific requirements for eligibility, and the age ranges mandated or allowed.[1] These differences lead to wide ranges in the estimates of the relative occurence of handicapping conditions (usually expressed as an incidence rate or percent of the total population expected to be classified as handicapped) and in the number of handicapped children thought to need special education services.

A second difficulty is the lack of commonly accepted national standards for special education programs and services. This void stems from an inadequate theory of education and from disagreement among special education experts over appropriate treatments. The difficulty is compounded by an absence of reliable and generalizable data on the effectiveness of various educational programs and services for different types of handicapped students. This results in great variation in actual program practices at the local level. Consequently, even at the state level, it is often difficult to obtain commonality among the availability of various special education programs and services, the placement patterns of students in special education programs and services, and key operating measures such as the student/teacher ratios and the use of instructional aids in each of the special education programs and services. Further, educational accounting and reporting systems used by local education

agencies are not designed to provide detailed programmatic information for special education on a regular basis.[2] All of these aspects combine to present serious obstacles to: 1) identifying exactly what set of instructional programs and supportive or related services should be considered; 2) specifying what resources comprise each program or service; and 3) determining the proportion or number of handicapped students who require each program and service.

A third difficulty occurs with the use of reported special education cost data as the basis for future cost projections, particularly with the common form of average cost per student. As reported by school districts and aggregated by state education agencies, the reported costs are generally prepared for other purposes than cost analysis and contain many hidden and inconsistent treatments of cost data which can materially affect their validity.[3] For example, a figure of $1750 as an average cost per handicapped student in a given state probably conceals as much information as it provides. Within that average, costs for various students in different programs may vary from $250 for speech and language therapy to over $15,000 for a residential program. The average figure gives no information on what types of students are being provided with what mix of programs and services. Further, due to price level differences among states, average costs for identical programs and services could vary substantially. Finally, even if the above difficulties could be resolved, the reported costs are historical data--a record of what costs were, not what they are expected to be. To be used for cost projection purposes, it must be assumed that the student population, program practices, and price levels which prevailed at the time the cost data were collected will continue essentially unchanged in the future. Otherwise, adjustments

to the historical cost data must be made to account for anticipated student program, and/or price changes--a difficult task when the historical composition of these elements is unknown. In sum, reported costs for special education, and particularly average cost per student figures, provide interesting, but incomplete information for cost estimation purposes.

As a result of these problems, there have been relatively few cost studies in special education and even fewer efforts to project the national costs of special education--for either the actual number of handicapped students served or for an estimate of the total handicapped population in need of special education.[4] Previous studies giving national cost estimates include the 1968-69 National Education Finance Project study by Rossmiller, et al.,[5] a Rand study in 1973,[6] and a study by Stultz in 1976.[7]

For purposes of cost estimation and projection, past cost studies of special education have several shortcomings. Actual program practices were either obscured or unidentified in the methodological procedures. Past program practices and costs were extrapolated to project future costs. Use of aggregated average costs per student by type of handicap (the most common approach) hid large cost variations in actual practice. Neither future changes in special education practices nor the uncertainty associated with their happening were recognized. Consequently, the usefulness of either their methodology or empirical results is limited.

Recognizing the difficulties of cost estimation in special education and the limitations of previous studies, a recent study by the author utilized a different methodolgy--a resource-cost model--to project the

national costs of educating all school aged handicapped children.[8] The results of this prior study indicated a most likely estimate for 1980-81 was $7.9 billion ($6.5 billion for instructional programs and $1.4 billion for related and support services), with a range of estimates from $3.9 billion to $20.5 billion. This wide range of possible costs was due to the significantly different assumptions about student and program characteristics underlying each of the estimates. The most important variables, in terms of their influence on the projected costs, were the estimated total incidence rate of handicapping conditions and the student/teacher ratios of the various instructional programs. Other variables of consequence were: the placement patterns of handicapped students in instructional programs, the extent to which instructional aides were used, the projected inflation rate, the average cost per student in other agency programs, teacher salaries, and the use of non-personnel resources. Furthermore, due to limited data available for related and support services, it is likely that these cost estimates included only a portion of the necessary costs of these services for handicapped students.

This paper represents an effort to improve upon initial cost estimates along several dimensions. First, the data base was enlarged from 26 to 28 states. Second, more recent and revised data was obtained for many of the original 26 states, replacing data in the original study. Third, aggregate national data in the original study were updated with more recent figures. Fourth, some of the original predictions about the future were checked against what actually happened or is happening, and modifications

were made when appropriate. Finally, a number of statistical analyses were conducted to investigate possible interrelationships among the different variables in the projection model. The purposes of all of these activities were twofold: 1) to improve the validity of the cost estimates; and 2) to narrow the range of probable cost estimates to a more meaningful and useful variation for policymakers.

Resource-Cost Model Methodology

The resource-cost model is a methodology in which the student characteristics and program configurations form the basis for estimating the costs of special education. The procedures require specification of the student population to be served, description of the instructional programs and services to be offered and the resources which comprise each program (e.g., teacher, aide, materials and supplies, travel allowance, classroom operating and maintenance expense), a price for each resource, determination of the distribution of students across the various programs and services, and the student/personnel ratios of the programs.

The data used in the model are of two types: actual values for current operations (e.g., actual number of students served by type of handicap, present percent of students in each instructional program, current salary and price levels); and planned or estimated future values (e.g., maximum percentage of handicapped students in the total student population, future percent of students in each instructional program, inflation rate). Thus, the resource-cost model is a planning model which utilizes actual values to initiate the planning process with current practice and employs assumptions about expected student needs and programming practices to estimate future costs. As a result, the cost projections are derived from specific and explicit expectations about the future special education operations and are not necessarily an extrapolation of past practices or costs. The model also projects future special student education enrollments as well as the number of special education personnel required to serve them.

Figure 1 shows the input data requirements, calculation process, and resultant projections of a resource-cost model for special education. This model is known as the Special Education Planning Model (SEPM) and its calculation steps are described below.

1. The total population in which handicapped students are found is specified (e.g., the K-12 enrollment in public and private schools).

2. The classification system to be used to identify handicapped students is selected along with an expected incidence rate for each category (e.g., educable mentally retarded (EMR): 2.00%; visually handicapped: 0.10%). The classification system specified may be other than by type of handicap, for instance by type of learning needs.

3. The number of students in each handicapping category expected to need special education services is then calculated (total population x incidence rates).

4. The percentages of handicapped students that are to receive each special education program are estimated by type of handicap (e.g., for EMR: 20% in consulting teacher program, 40% in resource rooms, and 40% in special classes).

5. The number in each category of handicapped students to receive each program is then calculated (step 3 x step 4). The total number of handicapped students in each program is also calculated.

6. The number of students per unit in each special education program for each category of handicapped student is specified (e.g., for EMR: 45 in consulting teacher program; 25 in resource rooms; 12 in special classes).

7. The number of units (and personnel) of each program required for each handicapping category is then calculated (step 5 ÷ step 6).

8. The number of personnel to serve each handicapping category and the number of personnel required for each program are then calculated by summing across programs for each handicapping category and across handicapping categories for each program, respectively.

9. The set of special education programs to be provided to handicapped students is determined (e.g., consulting teacher program, resource room, special class).

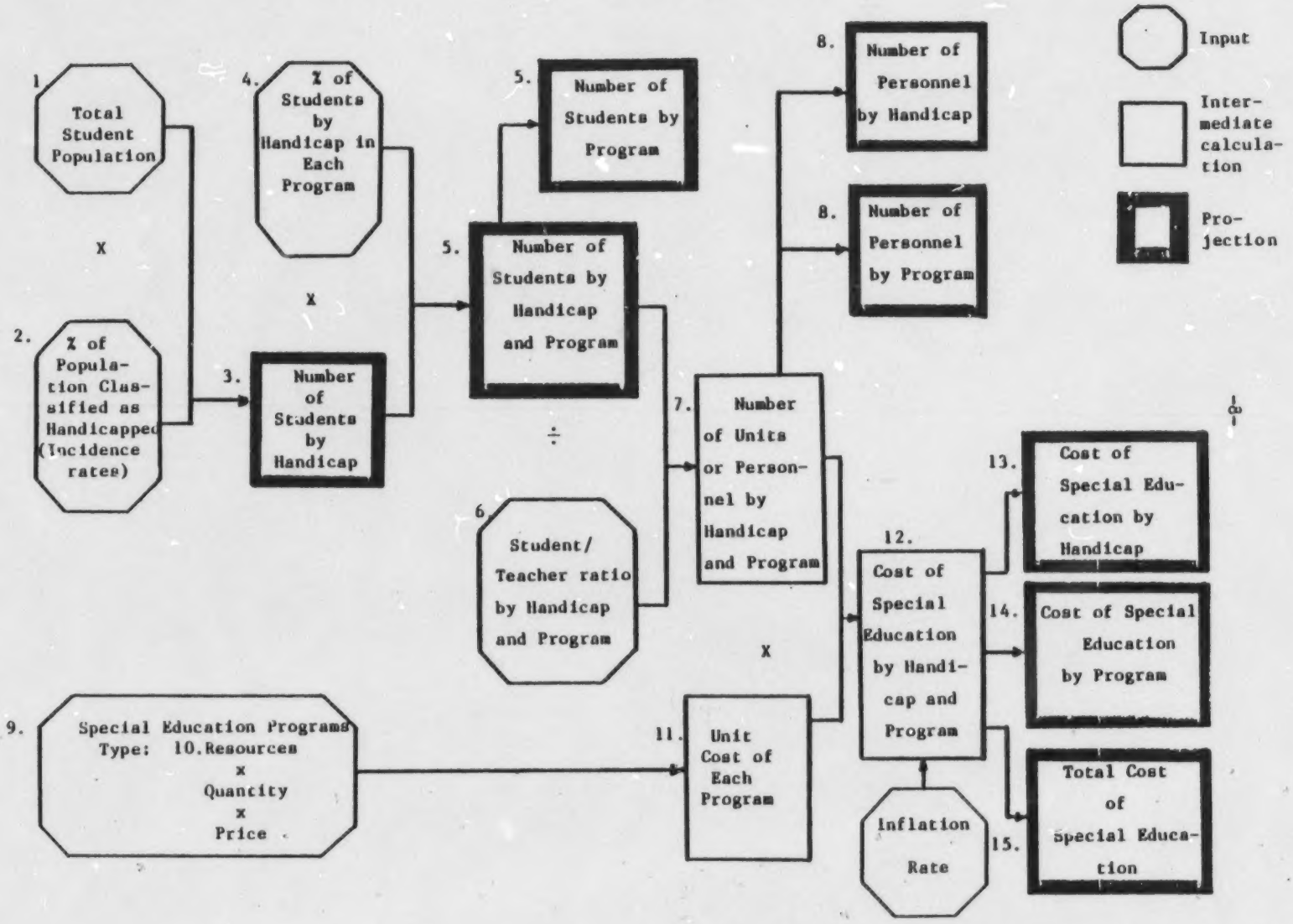
10. For each program the type and quantity of resources required in the program are selected along with a price for each resource (e.g., one teacher at $12,000, instructional materials at $500/class).

11. The unit price for each program is then calculated by summing the quantity times the price for each resource in the program.

Figure 1

Schematic Diagram of the

SPECIAL EDUCATION PLANNING MODEL


1. Total Student Population
X
2. % of Population Classified as Handicapped (Incidence rates)
3. Number of Students by Handicap
X
4. % of Students by Handicap in Each Program
5. Number of Students by Program
5. Number of Students by Handicap and Program
÷
6. Student/ Teacher ratio by Handicap and Program
7. Number of Units or Personnel by Handicap and Program
X
8. Number of Personnel by Handicap
8. Number of Personnel by Program
9. Special Education Programs Type; 10. Resources x Quantity x Price
11. Unit Cost of Each Program
12. Cost of Special Education by Handicap and Program
Inflation Rate
13. Cost of Special Education by Handicap
14. Cost of Special Education by Program
15. Total Cost of Special Education
Input
Intermediate calculation
Projection

12. The cost of special education for each handicapping category in each program is then calculated from the number of units required times the unit cost (step 7 x step 10).

13. The cost of special education for each handicapping category is then calculated by summing the costs of each category across all programs. Both constant and inflated costs are calculated.

14. The cost of special education for each program is then calcualted by summing the costs of each program across all handicapping categories. Both constant and inflated costs are calculated.

15. The total cost of special education is obtained by summing the costs of all handicapping categories (Σ step 13) or by summing the costs of all programs (Σ step 14). Both constant and inflated costs are calculated.

Several aspects of this approach differentiate it from previous cost studies in special education. While the model establishes a generalized structure of the special education instruction process, the essential variables, and their relationships, the user of the model specifies the values of the variables. This provides substantial flexibility since SEPM can be tailored to replicate special education programs at all levels of operation. Use of the model requires specifying the critical programmatic aspects of special education, both on a current and future basis, and cost projections are derived directly from these programmatic variables and relationships. Finally, because SEPM is a planning approach, its orientation is toward the future; the projections which are developed are based on expectations of future special education students and programs.

There, however, are several limitations to this approach which should be noted. Foremost is the dependence of SEPM results on the quality of the data used in its operation. Without accurate data for the values of the model's variables, the subsequent cost projections can be erroneous and misleading. An additional problem can be the

the unavailability in some areas of certain data required by the model. While SEPM is designed to function with data which are generally available, all educational agencies may not collect data in the form required by the model. Also, the assumptions concerning the future programmatic aspects of special education are not verifiable since they concern events which have not yet occurred. These values are generally based on the professional judgement of special educators and administrators and, as such, are subject to their biases. However, since the approach utilizes a model, alternative values can easily be substituted to test their impact.

Data Analysis

To operate SEPM, it was necessary to establish values for each of the variables in the model shown as an input in Figure 1. Primary among the data sources utilized were twenty-eight states which had used SEPM to develop their own state projections. These states represented a wide diversity in size, population, geography, demographic characteristics, special education philosophy, and programming practices. The values of the SEPM variables which they had established for their current and future special education programs provided the basis for the bulk of the programmatic data for the model. This grounded the model's projections in the actual and expected state special education program practices. Other data required by the model were of an aggregate or national total nature (e.g., total student population in grades K-12 in the United States); these data were obtained from other sources which provided them in summary form.

The data obtained from the selected sample states were first grouped by type of variable. On a variable-by-variable basis the individual state values were analyzed and, where necessary, made comparable (e.g., combining data for two different handicapping categories--blind and partially sighted--into a single category--visually impaired). To facilitate nationwide use and comparability of the projections, standardized groupings for the two major qualitative variables--handicapping condition and special education programs--were established. Based on the analysis of the states' reported data, most likely, low and high values for each of the other SEPM variables were derived. Additionally, aggregate national estimates of the school aged population were obtained from census sources. The process of establishing the values for each of the major variables is discussed below in further detail.

Total Student Population

The total student population is an estimate of the number of students, both non-handicapped and handicapped, in a particular age group. This population is estimated for each year of the planning period. The latest enrollment projections from the National Center for Educational Statistics (NCES) were used to estimate the future grade K-12 enrollments. Three different birthrate assumptions were used in their basic population projections. Series II was selected to represent the most likely estimate of future public and private school enrollments since the completed cohort fertility assumption most closely approximated the latest expected fertility data. Series I and Series III provided the high and low alternative values, respectively. In addition, the NCES enrollment projections were increased by the estimated enrollments in residential schools for handicapped children (approximately 133,000 students) to arrive at an adjusted enrollment projection.[10] The results are shown in Table 1.

Classification Categories

The classification categories are used to identify those students believed to need special education programs and services and to indicate the handicapping conditions which require special assistance. While other groupings could have been chosen, the categories selected by the states using SEPM were generally the traditional disability categories. An analysis of their choices indicated much overall similarity, although many individual differences did occur. An effort was made to use the federal reporting categories specified in P.L. 94-142 as

TABLE 1

PROJECTED ENROLLMENTS IN GRADES K-12
(Regular Day and Residential Schools)

Year	Enrollments (in thousands)		
	Series I (High)	Series II (Most Likely)	Series III (Low)
1976*	49,335	49,335	49,335
1977	48,820	48,820	48,820
1978	47,973	47,973	47,973
1979	47,067	47,063	47,061
1980	46,259	46,227	46,209

*actual enrollment

Source: National Center for Educational Statistics, Projections of Educational Statistics: 1986-87, p. 16-17.

the standardized categories in these projections. In all but three cases this approach was feasible: mentally retarded students were commonly reported in two categories, educable and trainable; deaf and hard of hearing students were more frequently combined into a single category; and a separate category was necessary for multiple handicapped students. Based on these data, ten standard categories were selected for the projections; they were educable mentally retarded (EMR), trainable mentally retarded (TMR), hearing handicapped, speech impaired, visually handicapped, seriously emotionally disturbed (SED), orthopedically handicapped (Ortho), other health impaired (OHI), specific learning disabilities (SLD), and multiple handicapped.

Incidence Rate

The incidence rate is an estimate of the expected percentage of children with a certain handicap to be found in the total population; it includes both those handicapped children presently identified and those anticipated to be found and served. Since these values determine the size of the population to be served, their values are critical to the cost projections. In fact, a prior study found that incidence rates were the single most important variable in estimating the costs of special education.[11]

The SEPM group of states used a variety of methods to estimate incidence rates. Some chose theoretical rates; some chose "prevalence" rates based on the number of handicapped students actually identified; and other states chose modified rates based on the number actually identified and on their professional judgement of the number of unidentified/unserved handicapped students needing special education services.

Numberous analyses of incidence rates were conducted to discover possible relationships between states' estimated categorical and total incidence rates and other logically connected state characteristics for which data were available from other sources. No consistent statistical relationship was found between the states' estimated incidence rates and geographic location, per capita school expenditures, size of the school age population, or percent of the population in metropolitan areas.

Failing to find any statistical relationships upon which to base national incidence rate estimates, two other approaches were utilized to develop possible values. First, values were derived by calculating the weighted average incidence rate for each category from the data reported by the SEEM group of states. (The weighting was based on the total school age population in each state.) Initial calculations included all 28 states, while subsequent ones eliminated extreme values reported by states (i.e., incidence rates of less than half or more than double the mean of the category). The weighted average values calculated from all states' data were selected as the most likely values of the categorical incidence rates since dropping the extreme values from the calculations had little effect (e.g., total incidence rate (sum of the rates for each category) calculated from all states' data was equal to 10.48% versus 10.33% calculated by eliminating extreme state values).

An analysis of federal data provided the low and high alternative values for the incidence rates. A lower bound on incidence rates was established as the percent of school-aged children served in 1977-78, the latest year for which data were available. The theoretical expected rates were used as the upper bound. All of these incidence rates are shown in Table 2.

Table 2

ESTIMATED INCIDENCE RATES AND TOTAL NUMBER OF STUDENTS SERVED

HANDICAPPING CATEGORY	ESTIMATED INCIDENCE RATES			TOTAL NUMBER OF HANDICAPPED STUDENTS SERVED 1976-1977 (3)
	LOW (1) VALUES	MOST LIKELY VALUES	HIGH (2) VALUES	
	ACTUAL % SERVED	WEIGHTED AVERAGE %	FEDERAL ESTIMATES %	
EMR	1.54	1.81	1.88	761,429
TMR	.41	.40	.42*	202,405
Hearing	.19	.29	.58	91,366
Speech	2.72	3.56	3.50	1,341,152
Vision	.08	.10	.10	40,166
SED	.60	1.03	2.00	294,461
Ortho	.18	.20	.18*	88,623
OHI	.27	.36	.32*	134,173
SLD	1.66	2.56	3.00	818,206
Multiple	.13	.17	.06	65,401
Total	7.78	10.48	12.04	3,837,382

1. Source: U.S. Department of HEW (OE). Progress Toward A Free Appropriate Education. January, 1979, p. 162. (Adjusted to reflect differences in student population).

2. Source: Kaskowitz, David. Validation of States Counts of Handicapped Children, Volume 2: Stanford Research Institute: Menlo Park, Ca. 1977, p.32. (Values starred were reported as combined numbers and separated in proportion to the existing ratios between those categories' most likely values.

3. Source: Statistics reported by the Bureau of Education for the Handicapped, U.S.O.E. for the purpose of P.L. 94-142.

Number of Students Served in Beginning Year

Operating the model requires information on the number of students served by each classification category in the beginning year of the planning period (i.e., 1976-77). These data were obtained from the Bureau of Education for the Handicapped (BEH), U.S.O.E. reports, which contained national totals of the number of handicapped students served in both public and private schools and institutions as of February, 1977. These reports were based on federally mandated child counting procedures in all states and provided the most comprehensive summary information on students in special education. The reported numbers of students in certain categories were rearranged to be compatible with the standard categories. The adjustments were: 1) the mentally retarded category was divided between educable mentally retarded students (EMR) and trainable mentally retarded students (TMR) in proportion to the number of students in each category identified by the SEPM states using the EMR and TMR categories (EMR: 79%; TMR: 21%); 2) deaf and hard of hearing categories were summed to form a single category; and 3) a fraction of the students from all categories, except speech, was allocated to a multiple category (2.62%). The results are also shown in Table 2.

Types of Instructional Programs

This variable specifies all of the types of instructional programs to be provided to handicapped students. A standardized set of eight instructional programs for the national projections was established based on a review and analysis of programs utilized by the SEPM group of states. Overall, there was a general similarity of programs offered among these states, although individual states differed in their specific

sets of instructional programs. All states did offer a range of possible placements for handicapped students—from supplemental assistance to full time special education to residential schools. This range was reflected in the standard set of instructional programs which is shown in Table 3, together with examples of corresponding states' programs.

Placement Patterns

Placement pattern refers to the distribution of handicapped students across instructional programs and is expressed for each handicapping category as a percentage of the total number of handicapped students served by each instructional program. SEPM uses two such matrices—beginning placement pattern (in the initial year of the planning period) and expected placement pattern (in the final year of the planning period). This allows the model to begin with an actual situation and then show movements of students among programs to reflect anticipated future programmatic trends.

For each handicapping category, the unduplicated number of students reported by the states using SEPM was summed. These totals were used as a base and divided into the total number of students for the given handicapping category in each instructional program--both primary placement and additional (duplicated) services—to arrive at a percentage of students by type of handicap in each program. These calculations yielded weighted average placement patterns for the SEPM states. This procedure was used for both the beginning (1976-77) and expected (1980-81) years using the states' data from each of these years in turn. The results are shown in Table 4.

TABLE 3

STANDARD INSTRUCTIONAL PROGRAMS

Standard Program (Abbreviacion)	Examples of State Programs
Indirect Services (IND SVC)	Aide in Regular Classroom, Consultive Services, Consultant Teacher, Consultive/ Diagnostic
Speech and Language Instruction (S & L)	Speech and Language, Supplemental Instruction, Itinerant Instruction, Communication Disorder Specialist
Other Direct Services (ODS)	Consultant-Itinerant, Itinerant Instruction, Individual Instruction, Tutor, Supplemental Instruction
Resource Room (RES RM)	Resource Room, Resource Services, Special Resource, Teacher-Consultant
Special Class (SP CLASS)	Self-Contained Classroom (Part or Full-Time), Special Class, District Center, Public Day School
Other Agency Day School (OA DAY)	Tuition/Contract, Private Agency, Private School, Special Day School, Out-of District
Residential School (RESIDENT)	Residential School, Public Agency, State School, State School for Deaf or Blind, State Institution, Private Residential
Hospital and Homebound (HOSP/HBD)	Hospital, Homebound, Home and Hospital

Alternative placement patterns were only needed for 1980-81 since the 1976-77 pattern represented current practice. The wide variety of placement patterns utilized by the SEPM states and their incompatibility when reported as percentages of students in different programs made a detailed statistical analysis of the variations in state placement patterns difficult. Rather, the major programmatic trend of mainstreaming was used as the basis for establishing alternative 1980-81 placement patterns. A more conservative future placement pattern than the most likely pattern was selected as the high alternative. In this alternative the 1980-81 placement percentages equalled 1976-77 placement percentages (i.e., no change in the present placement pattern was assumed). On the other side of the most likely values, a low alternative placement pattern was established which incorporated a greater shift of students into programs considered less restrictive and a greater use of additional services, primarily speech and language instruction. These values are shown in Table 5.

Number of Students Per Unit

The number of students per unit variable represents the average number of pupils in one unit of an instructional program; since most programs are specified in classroom units, this amounts to a student/teacher ratio for each handicapping category and instructional program combination.

To establish the most likely values for the projections, the mean number of students per unit for each instructional program and handicapping category was calculated from the responses of the SEPM group

TABLE 4

CURRENT AND MOST LIKELY
STUDENT PLACEMENT PATTERN

		IND SVC	S&L	ODS	RES RH	SP CLASS	DA DAY	RESIDENT	HOSP/HBD
EMR	BEGIN	0.031	0.038	0.021	0.394	0.569	0.012	0.013	0.0
	EXPECTED	0.042	0.059	0.055	0.464	0.491	0.017	0.006	0.0
TMR	BEGIN	0.020	0.060	0.005	0.017	0.802	0.039	0.132	0.009
	EXPECTED	0.022	0.077	0.014	0.026	0.819	0.047	0.100	0.008
HEARING	BEGIN	0.024	0.330	0.152	0.185	0.366	0.086	0.170	0.037
	EXPECTED	0.041	0.225	0.234	0.199	0.252	0.193	0.086	0.023
SPEECH	BEGIN	0.001	0.972	0.001	0.009	0.017	0.0	0.0	0.0
	EXPECTED	0.002	0.978	0.001	0.010	0.009	0.0	0.0	0.0
VISION	BEGIN	0.021	0.003	0.216	0.203	0.350	0.057	0.092	0.070
	EXPECTED	0.030	0.004	0.224	0.241	0.348	0.058	0.070	0.063
SED	BEGIN	0.047	0.038	0.026	0.264	0.543	0.082	0.063	0.028
	EXPECTED	0.030	0.033	0.056	0.360	0.423	0.097	0.038	0.055
ORTHO	BEGIN	0.016	0.086	0.300	0.194	0.320	0.012	0.051	0.142
	EXPECTED	0.042	0.117	0.274	0.243	0.293	0.013	0.034	0.156
OHI	BEGIN	0.032	0.006	0.023	0.125	0.564	0.008	0.068	0.215
	EXPECTED	0.033	0.017	0.029	0.207	0.416	0.010	0.062	0.283
SLD	BEGIN	0.056	0.030	0.071	0.698	0.190	0.022	0.001	0.0
	EXPECTED	0.073	0.053	0.099	0.703	0.173	0.018	0.001	0.0
MULTIPLE	BEGIN	0.049	0.035	0.034	0.033	0.630	0.041	0.287	0.002
	EXPECTED	0.039	0.079	0.041	0.056	0.695	0.024	0.214	0.006

TABLE 5

CURRENT AND GREATER MAINSTREAMING
STUDENT PLACEMENT PATTERN

		IND SVC	SCL	CDS	RES RH	SP CLASS	CA DAY	RESIDENT	HOSP/HBD
EMR	BEGIN	0.031	0.038	0.021	0.394	0.569	0.012	0.013	0.0
	EXPECTED	0.060	0.120	0.060	0.530	0.400	0.0	0.0	0.0
TMR	BEGIN	0.020	0.060	0.005	0.017	0.802	0.039	0.132	0.009
	EXPECTED	0.040	0.150	0.030	0.030	0.690	0.020	0.055	0.005
HEARING	BEGIN	0.024	0.330	0.152	0.165	0.366	0.086	0.170	0.037
	EXPECTED	0.050	0.300	0.300	0.250	0.300	0.100	0.050	0.010
SPEECH	BEGIN	0.001	0.972	0.001	0.009	0.017	0.0	0.0	0.0
	EXPECTED	0.005	0.985	0.0	0.005	0.005	0.0	0.0	0.0
VISION	BEGIN	0.021	0.003	0.216	0.203	0.350	0.057	0.092	0.070
	EXPECTED	0.040	0.010	0.300	0.300	0.300	0.050	0.050	0.0
SED	BEGIN	0.047	0.038	0.026	0.264	0.543	0.082	0.063	0.028
	EXPECTED	0.050	0.100	0.100	0.450	0.350	0.050	0.020	0.030
ORTHO	BEGIN	0.016	0.086	0.300	0.194	0.320	0.012	0.051	0.142
	EXPECTED	0.080	0.150	0.300	0.330	0.250	0.010	0.010	0.100
OHI	BEGIN	0.032	0.006	0.023	0.125	0.564	0.008	0.068	0.215
	EXPECTED	0.070	0.050	0.050	0.300	0.350	0.0	0.050	0.250
SLD	BEGIN	0.054	0.030	0.071	0.698	0.190	0.022	0.001	0.0
	EXPECTED	0.150	0.100	0.100	0.750	0.140	0.010	0.0	0.0
MULTIPLE	BEGIN	0.049	0.035	0.034	0.033	0.630	0.041	0.287	0.002
	EXPECTED	0.050	0.150	0.080	0.100	0.650	0.015	0.200	0.005

of states. Alternative and high values were obtained by subtracting and adding one standard deviation from the mean value of the number of students per unit. These values are shown in Table 6. To check the reasonableness of these data, a comparison was made with the results of a recent study of state regulations governing the number of students per unit.[12] The most likely, low, and high values calculated for the projections were reviewed to insure that they were within the range of reported state regulations. In the few cases where a calculated value was outside the reported range, the value was changed to the end point of the range.

Resources, Quantities, and
Prices for Instructional Programs

In the resource-cost model methodology used by SEPM, each instructional program is specified in terms of selected, identifiable resources, each present in a specific quantity with an associated price. Combined, they yield a unit price for each instructional program. To establish the resources, quantities, and prices for the projections, a review and analysis of the corresponding data from the states using SEPM was conducted. Resources used most frequently were selected as the most likely resources for each respective instructional program. Other resources, which were used by some, though not most, states were included in the alternative low and high formulations of the resources for the programs.

To establish prices, resources were divided into three groups--personnel, non-personnel, and cost per student. The personnel related resources consisted of teacher salaries, aide salaries, and fringe

TABLE 6

ESTIMATED NUMBER OF STUDENTS PER UNIT

CATEGORY	PROGRAM								
	Estimate	Ind Svc	S & L	ODS	RR	Sp Class	OA Day	Resident	H/H
EMR	ML	88	67	33	22	14	1	1	6
	HIGH	40*	49	21	15	11	1	1	6
	LOW	140	85	45	29	17	1	1	5
TMR	ML	88	60	24	20	11	1	1	6
	HIGH	40*	39	16	10	9	1	1	5
	LOW	140	81	32*	30	13	1	1	7
Hearing	ML	79	65	21	15	9	1	1	8
	HIGH	35*	47	10	7	6	1	1	8
	LOW	98	83	32	23	12	1	1	8
Speech	ML	75	67	25	20	9	1	0	0
	HIGH	40*	51	25	11	6	1	0	0
	LOW	110*	83	25	29	12	1	0	0
Vision	ML	86	72	24	17	9	1	1	4
	HIGH	32	51	12	9	6	1	1	4
	LOW	140	93	36	25	12	1	1	5
SED	ML	69	73	26	20	10	1	1	7
	HIGH	32*	56	16*	12	7	1	1	3*
	LOW	118	90	36	28	13	1	1	11
Ortho	ML	76	65	22	17	11	1	1	6
	HIGH	20*	46	18	9	8	1	1	4
	LOW	140	84	26	25	14	1	1	8
OHI	ML	78	54	24	19	12	1	1	8
	HIGH	20*	43*	18	12	9	1	1	4
	LOW	140	65	30	26	15	1	1	12
SLD	ML	75	66	28	24	12	1	1	10
	HIGH	32*	55	19*	17	9	1	1	5
	LOW	120	77	37	31	15	1	1	15
Multiple	ML	130	70	18	23	7	1	1	8
	HIGH	110*	51	12	13	5	1	1	6
	LOW	150*	89	24	33	9	1	1	10

*In some instances, due to the small number of observations, plus or minus one standard deviation from the mean value exceeded the range of values found among the reported state data. In these cases, the end value in the range was used to avoid an input value more extreme than was present in the base data.

benefits. Due to the great variability in reported salaries from the SEPM states, an NEA estimate of the national average teacher salary ($13,312 in 1976-77)[13] was used as the most likely value. Alternative values for teacher salaries were established at plus and minus ten percent of the most likely value. Aide salaries were established as proportions of the most likely teacher salary using the relationships between aide and teacher salaries in the SEPM states' data. The mean aide salary to teacher salary ratio (.45) was used to calculate the most likely value for aide salary, and the low and high aide/teacher salary ratios (.29 and .64) to calculate the alternative values. Similarly, fringe benefits were calculated based on the benefit levels reported by the SEPM states (most likely of 13%, low of 7%, and high of 20% applied against the respective salaries).

For the non-personnel resources--instructional materials, travel, and maintenance and operation expenses--specified for a given instructional program, the most likely values for the prices were taken to be the average of the prices reported by states for those resources. Low and high alternative values for prices for these resources were established by reviewing the number of states using a resource in a specific instructional program, the likelihood of the generalized use of this resource by other states, the range of reported prices, and the distribution of the reported prices.

The final type of resource used by the SEPM group of states was an average cost per student in a particular instructional program. This designation was most common in programs whose budgets and operations were controlled by agencies other than the public schools--other agency day schools and residential schools. For these programs, the most likely

value for the price was established as the mean value of the average cost per student for those states reporting. The alternative values were determined through an analysis of the range and distribution of the reported costs per student for these programs. The resulting most likely and alternative values for the resources, quantities, and prices for all programs are shown in Table 7.

Inflation Factor

In order to reflect changes in the price levels in future years, SEPM uses an inflation factor, which specifies the average annual rate of inflation of the initial prices expected over the planning period. The most likely value for this variable was established as the weighted average inflation factor (weighted by the total student population of each state) for the SEPM group of states. Alternative low and high values of plus and minus one standard deviation from the unweighted average inflation factor for these states were also calculated. These results are shown in Table 8.

There was some concern that the rates of inflation selected by the states did not accurately reflect the actual changes in price levels between 1976-77 and 1980-81. To investigate this potential problem the rate of actual salary increases were compared with the assumed inflation rates. It was found that the average annual rate of teachers salaries from 1976 through 1979 was 6.2%[14] while the most likely inflation factor used in the projections was 6.65%. Since teacher salaries comprised the bulk of the projected costs and since it is probably that the other cost items had higher rates of cost increases, the most likely inflation rate appeared to be reasonable.

TABLE 7

RESOURCES AND PRICES FOR INSTRUCTIONAL PROGRAMS

PROGRAM	RESOURCE	MOST LIKELY	LOW	HIGH
IND SVC	Teacher	$13,312	$11,981	$14,643
	Benefits	1,731	839	2,929
	Materials	305	200	400
	Travel	837	670	1,000
	Maint. & Op.	0	0	236
	TOTAL	$16,185	$13,690	$19,208
S&L	Teacher	$13,312	$11,981	$14,643
	Benefits	1,731	839	2,929
	Materials	582	300	1,000
	Travel	855	627	1,000
	Maint. & Op.	0	0	261
	TOTAL	$16,480	$13,747	$19,833
ODS	Teacher	$13,312	$11,981	$14,643
	Benefits	1,731	839	2,929
	Materials	622	300	1,000
	Travel	913	730	1,000
	Maint. & Op.	0	0	168
	TOTAL	$16,578	$13,850	$19,740
RES RM	Teacher	$13,312	$11,981	$14,643
	Aide (quantity)	(.33/unit)	(0/unit)	(1.0/unit)
	(price)	($5,990)	($3,860)	($8,520)
	cost	1,977	0	8,520
	Benefits	1,988	839	4,633
	Materials	603	400	1,000
	Maint. & Op.	645	0	1,474
	TOTAL	$18,525	$13,220	$30,270
SP CLASS	Teacher	$13,312	$11,981	$14,643
	Aide (quantity)	(.51/unit)	(.25/unit)	(1.0/unit)
	(price)	($5,990)	($3,860)	($8,520)
	cost	3,055	965	8,520
	Benefits	2,128	907	4,633
	Materials	769	500	1,000
	Maint. & Op.	810	0	1,737
	TOTAL	$20,074	$14,353	$30,533
OA DAY	Avg. Cost/Stud.	$ 3,618	$ 2,500	$ 5,000
RESIDENT	Avg. Cost/Stud.	$10,390	$ 8,000	$14,000
HSP/HBD	Teacher	$13,312	$11,981	$14,643
	Benefits	1,731	839	2,929
	Materials	378	226	500
	Travel	689	482	1,000
	TOTAL	$16,110	$13,528	$19,072

TABLE 8

INFLATION FACTORS

Most Likely (weighted average rate)	6.65%
Low Alternative (minus one standard deviation)	5.58%
High Alternative (plus one standard deviation)	7.96%

Related Services

Related services are those services of a developmental, corrective, or supportive nature which are provided to help handicapped students to benefit from the instructional programs in which they are enrolled.[15] SEPM distinguishes between two types of related services. The first type is specified related services, which are those associated with a certain handicapping category (e.g., special transportation for TMR students). The second type is nonspecific related services, which are those provided to benefit more than one category of handicapped students (e.g., inservice training for teachers, supervision).

Related services data provided by the states using SEPM were much less comprehensive than those for the instructional programs. Of the twenty-eight sample states, only nine reported specific related services data, while only thirteen reported nonspecific related services data. There was, therefore, a shortage of data on which to base national projections. However, since related services are an important part of special education and they are explicitly included in P.L. 94-142 and many state statutes, their costs should not be forgotten. Therefore, projections of related services were developed to provide some indication of the general magnitude of the costs involved.

The most commonly reported specific related services were selected for inclusion in the projections. These were special transportation for five different categories of handicapped students and physical therapy for orthopedically handicapped students. Calculations from the states' data of the estimated cost per student and the percentages of students receiving these services are shown in Table 9. Non-specific related

services estimates were based on data reported by all fifty states to the Bureau of Education for the Handicapped. The data utilized for these projections included estimates of the numbers of several types of support personnel who were: a) employed in 1976-77, b) needed in 1977-78, and c) needed in 1978-79, which were utilized in the cost projections as the low, most likely, and high values, respectively. These personnel estimates were combined with salary levels which were estimated relative to the most likely teachers' salaries to project the costs for non-specific related services. These data are also given in Table 9.

TABLE 9

RELATED SERVICES DATA

Related Service	Category	Cost	1980 Service Level		
			Low	Most Likely	High
Specific					
Special Transportation	TMR	$ 777/student	-	55% of students	-
	Hearing	$ 596/student	-	37% of students	-
	Vision	$ 571/student	-	49% of students	-
	Ortho	$ 769/student	-	64% of students	-
	Multiple	$ 521/student	-	85% of students	-
Physical Therapy	Ortho	$ 472/student	-	34% of students	-
Non-Specific					
Inservice Training	-	$ 303/teacher	-	223,940 teachers	-
Psychologists	-	$14,000/staff	17,730 staff	21,713 staff	25,659 staff
Non-Inst. staff	-	$13,312/staff	17,478 staff	21,257 staff	23,756 staff
Supervisors	-	$14,500/staff	10,161 staff	12,026 staff	13,676 staff
Work Study Coord.	-	$14,500/staff	6,854 staff	8,900 staff	11,111 staff
Social Workers	-	$14,000/staff	5,880 staff	7,975 staff	10,218 staff
Phys. Ed. Ther.	-	$13,312/staff	5,014 staff	6,852 staff	8,430 staff
Occ. & Rec. Ther.	-	$13,750/staff	1,903 staff	3,349 staff	4,618 staff

Most Likely Cost Projections

National cost projections for both instructional programs and related services were developed utilizing the most likely values of each of the model's variables. For instructional programs, this produced a most likely cost estimate to serve all school aged handicapped children in 1980-81 of $7.2 billion (inflated), an increase of approximately $2.3 billion (50%) from 1976-77 estimates. Inflation, however, accounted for the bulk of that increase with only a $777 million (16%) increase projected in constant dollars. Table 10 presents these cost estimates by type of handicapping classification. Over the five year period the largest cost increases appeared in the specific learning disabilities ($353 million or 43%) and severely emotionally disturbed categories ($299 million or 43%). Both of these projected costs increases stemmed primarily from the relatively large increases in the estimated number of students to be served by 1980-81 (365,000 or 45% for SLD and 182,000 or 62% for SED). These estimates, in turn, were derived from the incidence rate assumptions used in the most likely projections. It is worth noting that these two classifications are among the most difficult to define and diagnose precisely.

These most likely cost projections are also presented by type of instructional program in Table 11. These estimates indicate that the resource room program had the largest expected cost increase ($408 million or 48%), while other programs with large projected cost increases were other agency day schools ($180 million or 67%), special classes ($126 million or 6%), and speech and language instruction ($94 million or 27%). On the other hand, the costs of residential schools are estimated

TABLE 10

COSTS -- BY CLASSIFICATION AND YEAR
(IN THOUSANDS OF DOLLARS)

CLASSIFICATION	YEAR				
	76-77	77-78	78-79	79-80	80-81
EMR	1029213	1029674	1033197	1043517	1061281
TMR	615217	602157	578774	548905	514772
HEARING	311141	318531	331775	347911	361449
SPEECH	383869	389538	401420	420326	445973
VISION	104436	104832	105886	107792	110504
SED	702676	737031	802627	894135	1002311
ORTHO	177341	176286	174662	173248	172299
OHI	302983	308435	319870	337992	362768
SLD	824885	859550	929282	1035427	1177601
MULTIPLE	327868	329656	333585	339854	347469
TOTAL (CONSTANT $)	4779629	4855690	5011078	5249107	5556427
TOTAL (INFLATED $)	4779629	5178591	5699708	6367478	7188504

TABLE 11

COSTS -- BY INSTRUCTIONAL PROGRAM AND YEAR
(IN THOUSANDS OF DOLLARS)

TYPE OF PROGRAM	PRICE PER UNIT	YEAR 76-77	77-78	78-79	79-80	80-81
INDIRECT SERVICES	16185	20732	21882	24309	28161	33648
SPEECH & LANGUAGE INSTR.	16480	350150	358505	376007	404171	443868
OTHER DIRECT SERVICES	16578	90101	96616	110624	134082	169675
RESOURCE ROOM	18524	846380	883168	959543	1081153	1254167
SPECIAL CLASS	20073	1951677	1967234	1997423	2038794	2078257
OTHER AGENCY DAY SCHOOL	3618	268242	283792	316491	369654	447571
RESIDENTIAL SCHOOL	10390	1118234	1103791	1071624	1013710	912553
HOSPITAL & HOMEBOUND	16110	134147	140736	155090	179417	216695
TOTAL (CONSTANT $)		4779663	4855724	5011111	5249142	5556454
TOTAL (INFLATED $)		4779663	5178628	5699745	6367521	7188539

to decline (-$205 million or -18%) due to the shift of students into less restrictive settings (i.e., other agency day schools and special classes).

For related services, the most likely cost projections yielded an estimate of $1.8 billion for 1980-81. The bulk of these projected costs were for the support personnel--psychologists, other non-instructional staff, supervisors, work-study coordinators, school social workers, physical education instructors, and occupational and recreational therapists. The remainder of the estimated costs were for specific related services and for inservice training. Table 12 presents these results.

Supplemental projections were also developed for the estimated total number of students to be served and the instructional personnel that would be needed. The unduplicated special education enrollment projections showed an increase of approximately one million handicapped students in special education programs (26%) by 1980-81 to reach full service with the largest increases in the categories of SLD, SED, and Speech Impaired (305,000 students). The projected duplicated student enrollments (in which students were counted in each program they received) served showed an increase of 1.2 million handicapped students (29%). Students in other instructional programs who were also receiving additional speech and language instruction accounted for the majority of the double counting by program. The programs with the largest projected enrollment increases by 1980-81 were resource rooms (486,000 students or 47%) and speech and language instruction (380,000 students or 27%). Corresponding projections of the required number of personnel by 1980-81 indicated an estimated increase of 45,000 teachers (25%) and 10,500 aides (16%) to

TABLE 12

SUMMARY: STUDENTS, PERSONNEL, COSTS FOR RELATED SERVICES
(IN THOUSANDS OF DOLLARS)

CLASSIFICATION	YEAR				
	76-77	77-78	78-79	79-80	80-81
TMR					
SP TRANS					
STUDENTS	93106	93701	95130	97754	101699
PERSONNEL	0	0	0	0	0
COSTS	72343	72805	73916	75954	79020
HEARING					
SP TRANS					
STUDENTS	28323	30187	34088	40396	49601
PERSONNEL	0	0	0	0	0
COSTS	16880	17991	20316	24076	29562
VISION					
SP TRANS					
STUDENTS	12049	12968	14898	18035	22651
PERSONNEL	0	0	0	0	0
COSTS	6879	7404	8506	10297	12933
ORTHO					
P T					
STUDENTS	13293	14988	18445	23837	31434
PERSONNEL	0	0	0	0	0
COSTS	6274	7074	8706	11251	14836
SP TRANS					
STUDENTS	24814	28026	34573	44784	59170
PERSONNEL	0	0	0	0	0
COSTS	19081	21551	26586	34438	45501
MULTIPLE					
SP TRANS					
STUDENTS	32046	35003	41251	51509	66798
PERSONNEL	0	0	0	0	0
COSTS	16695	18236	21491	26836	34801
INSERV					
STUDENTS	0	0	0	0	0
PERSONNEL	0	0	0	0	0
COSTS	27150	31220	39361	51572	67853

PSYCH					
STUDENTS	0	0	0	0	0
PERSONNEL	17730	18129	18925	20120	21713
COSTS	248220	253796	264948	281677	303981
ONISTAFF					
STUDENTS	0	0	0	0	0
PERSONNEL	17478	17856	18612	19746	21257
COSTS	232667	237697	247758	262850	282973
SUPERV					
STUDENTS	0	0	0	0	0
PERSONNEL	10161	10348	10721	11280	12026
COSTS	147334	150038	155447	163559	174376
WORKSTCO					
STUDENTS	0	0	0	0	0
PERSONNEL	6854	7059	7468	8082	8900
COSTS	99382	102349	108283	117183	129050
SSW					
STUDENTS	0	0	0	0	0
PERSONNEL	5880	6090	6509	7137	7975
COSTS	82320	85252	91118	99917	111650
PHYS.ED					
STUDENTS	0	0	0	0	0
PERSONNEL	5014	5198	5566	6117	6852
COSTS	66746	69193	74086	81426	91213
OT/RT					
STUDENTS	0	0	0	0	0
PERSONNEL	1903	2048	2337	2771	3349
COSTS	26166	28154	32130	38095	46048
TOTAL COST					
CONSTANT $	1068137	1102760	1172652	1279131	1423797
INFLATED $	1068137	1176093	1333799	1551661	1842005

serve the projected most likely number of handicapped student. The largest areas of increase by category were teachers of SLD students (18,000 teachers or 46%) and SED students (12,000 teachers or 56%). By type of program the greatest increase was projected for the resource room teachers (22,000 or 48%). These projections are included in the Appendix.

At this point it is useful to consider the combined effects of the projected increases in costs and students on the average cost per handicapped student. As Table 13 shows, except for the effects of inflation, the average cost of serving a handicapped student is estimated to decrease from 1976-77 to 1980-81. This decrease is the net result of several key assumptions in the most likely projections: 1) the majority of the new students will tend to be mildly handicapped and consequently will be assigned to relatively low cost programs; 2) there will be some shift of existing students toward less restrictive (and lower cost) programs; and 3) there will be a greater use of additional services (rising from 5.6% to 8.1% of the unduplicated enrollment).

TABLE 13

AVERAGE COST PER HANDICAPPED STUDENT*

COST TYPE	PROGRAM	1976-77	1977-78	1978-79	1979-80	1980-81
Constant $	Instructional Program	1246	1236	1216	1187	1147
	Related Svc.	278	281	284	289	293
	Total	1524	1517	1500	1476	1440
Inflated $	Instructional Program	1246	1318	1386	1439	1484
	Related Svc.	278	299	324	350	380
	Total	1524	1617	1710	1789	1864

*Special education costs only

Now that the most likely cost estimates have been presented, it is important to review their limitations. First, the cost projections are based completely on the data and assumptions underlying each of the SEPM variables. Changes in the most likely values of any of the model variables would cause changes in the most likely cost projections. (The next two sections of the paper discuss the uncertainty associated with each of the variables and the impact on the projected costs). Second, the projections for instructional programs are the more reliable due to their extensive state data base, while those for related services are much more speculative. Third, the projections are for the special education costs of school age children only. Cost estimates for instructional programs and related services for preschool and postschool aged handicapped students are not included, which means that the total special education costs for all handicapped children ages 3-21 (the mandated ages in P.L. 94-142 and many state statues) would be higher than those shown in the study. Fourth, the 1980-81 projections are not actual costs, but rather they are estimates of what the costs would be if all school aged handicapped children were to be served in an appropriate manner. Finally, the cost projections are of the specifically identifiable special education costs; they are not excess costs since the equivalent costs of providing a regular education for handicapped students in separate instructional settings have not been deducted, nor are they the total costs of educating handicapped students since the costs of regular education programs and services provided for these children have not been included.

Sensitivity Analyses

To show the effects of the uncertainty associated with each model variable, a series of sensitivity analyses were conducted. These analyses involved substituting first the low and then high values for the most likely value of each variable, one variable at a time, and then reprojecting the costs. The difference between the new cost projections and the original most likely cost projection gave the cost impact of the low and high alternative values of each variable. The results for both the instructional programs and related services are shown in Table 14.

The variable with the largest effect on costs was the assumed total incidence rate. The most likely value of this variable of 10.48% was established from the weighted average incidence rate for the states using SEPM. The low (7.78%) and high (12.04%) values represented the most recently available percentage of students served (1977-78) and the theoretical federal percentage, respectively. If, instead of the most likely incidence rate, the total percentage of school-age students ultimately served in special education turned out to be the low value (i.e., no growth in special education enrollments), then the reduction in cost projections would be about $1.4 billion (assuming all other variables remain at their most likely values). Conversely, if the high value was the better estimate for the incidence rate, then the increased costs would be about $1.3 billion. These differences represent approximately minus and plus 25% of the most likely cost projections for this one variable alone.

The student/teacher ratios for instructional programs were the variables with the second greatest impact on projected costs. The most likely values in the category/program matrix specified for student/teacher ratios (Table 6) yielded a weighted average student/teacher ratio of 22 students per unit. While this value was not used in the projections, it was calculated for Table 14 (along with the analogous alternative values) in order to provide a single

TABLE 14

RESULTS OF SENSITIVITY ANALYSES

Variable	ML Value	Alternative		Cost Difference	% Diff.
		Type	Value		
Incidence Rate	Total = 10.48%	LOW	7.78%	-$1,420,000,000	-25.5
		HIGH	12.04%	$1,285,000,000	23.1
Student/Teacher Ratio	Avg. = 22	LOW	27	-$ 633,000,000	-11.4
		HIGH	16	$1,814,000,000	32.6
Salaries and Benefits	Teacher $13,312	LOW	$11,981	-$ 696,000,000	-12.5
		HIGH	$14,643	$ 827,000,000	14.9
Placement Patterns	Future Most Likely Pattern	LOW	More Mainstreaming	-$ 639,000,000	-11.5
		HIGH	Current Pattern	$ 469,000,000	8.4
Use of Aides (aide/teacher)	Res. Rm. = .33 Sp. Class = .51	LOW	RR = 0; SC = .25	-$ 333,000,000	- 6.0
		HIGH	RR = 1.0; SC = 1.0	$ 576,000,000	10.4
Cost/Student in Other Agency Programs	$10,390 for Residential $ 3,618 for Day School	LOW	$8,000; $2,500	-$ 348,000,000	-6.3
		HIGH	$14,000; $5,000	$ 488,000,000	8.8
Inflation Rate	6.65%	LOW	5.58%	-$ 285,000,000	-4.0
		HIGH	7.96%	$ 359,000,000	5.0
Non-Personnel Resources	$1403/unit	LOW	$661/unit	-$ 193,000,000	-3.5
		HIGH	$2401/unit	$ 239,000,000	4.3
Total Student Population in 1980	46,227,000 students	LOW	46,209,000	-$ 2,000,000	-0.1
		HIGH	46,529,000	$ 4,000,000	.1
Related Services	82,072 personnel	LOW	65,020 personnel	-$ 306,000,000	-16.6
		HIGH	97,468 personnel	$ 277,000,000	15.1

index number to represent the values in the full matrix. The single weighted average values for the low cost and high cost projections were 27 and 16, respectively. Of particular interest were the values resulting in the high cost projections, (which were actually the lower numerical values of the variable) which caused the largest single cost difference of $1.8 billion by reducing the average student/teacher ratio from 22 to 16. This indicated that the cost projections were extremely sensitive to lowering the student/teacher ratio, a common change proposed for special education programs.

The results of the sensitivity analyses for the other model variables are discussed below in order of their cost impact: For personnel salaries and benefits, a 10% change in teacher salaries combined with larger changes in aide salaries and personnel benefits resulted in $700-800 million cost differences. Maintaining the current placement pattern of students in instructional programs in 1980-81 would cause $470 million increase when compared to the expected shifts toward least restrictive environments, and a further shift toward greater use of mainstreaming placements could reduce costs by over $600 million. Increasing the use of aides to one full aide for each teacher in the resource room and special class programs would raise costs by almost $600 million, and eliminating aides from resource rooms and halving their frequency in special classes would reduce costs by over $300 million. If the average cost per student in other agency day school and residential programs were lower by approximately 25% the projected cost would be reduced by $350 million, and if the average cost per student were higher by approximately 35% the projected costs would increase by almost $500 million. A change of approximately one percent on the annual rate of inflation resulted in cost differences of from almost $300 million to over $350 million in the fifth year. A change of approximately $1,000 per unit in non-personnel resources caused

cost differences of approximately $200 million. Finally, the small differences in the projected K-12 enrollment for the total student population had a negligible effect on the cost projections.

Only a single sensitivity analysis was conducted for related services given the limitations of the data base. The changes in the projected number of personnel engaged in related services activities of approximately 16,000 resulted in cost differences of about $300 million.

Alternative Cost Projections

Given the uncertainty associated with the values of the underlying variables in the most likely cost projections, it would be more realistic to use a range of feasible cost estimates than a single point estimate. To do this, sets of low and high alternative values were established around the most likely values using the results of the sensitivity analyses, knowledge of current trends in special education and the national economic conditions, and arbitrary, but hopefully reasonable, assessments by the author. The sets of low and high values are intended to represent the lower and upper bounds on the combination of events that may occur. It was necessary to consider all of the variables concurrently in establishing values for the alternative cost projections in order to avoid compounding a series of possible, but not probable events into a final, highly unlikely set of joint occurances. Each of the low and high values utilized in the sensitivity analyses was established separately and represented a more extreme possibility for that individual variable. As a result, it is not appropriate to sum the individual cost differences from the most likely projections, nor to utilize all of the low or high values in a single cost projection. To illustrate the point, cost projections for 1980-81 based on only the low values of the variables (including the effects of inflation) totaled approximately half of the 1976-77 reported costs of special education.

The low and high combinations of values to estimate the range of probable costs of special education are shown in Table 15. The values are indicated in terms of the previously developed model values for the sensitivity analyses.

The model variables in which there were important variations for the alternative values were :

TABLE 15

VALUES FOR LOW AND HIGH ALTERNATIVE COST PROJECTIONS

VARIABLE	LOW PROJECTION VALUES	HIGH PROJECTION VALUES
Total Student Population	Most Likely	Most Likely
Incidence Rate (Total)	Low + 1%	Most Likely + 0.5%
Salaries and Benefits	Most Likely	High
Non-Personnel Resources	Low	High
Cost/Student in Other Agency Programs	Most Likely	High
Use of Aides	Most Likely	Most Likely
Placement Patterns	Current (No Change)	More Mainstreaming
Student/Teacher Ratio	Most Likely + 10%	Most Likely - 10%
Inflation Rates	Most Likely	High
Related Services	Low	High

1) incidence rate, where the low value was selected as one additional percentage point over the most recent percentage of students served (7.78% + 1.00% = 8.78%) to allow for some growth in the population to be served (13% by 1980-81), and the high value was selected as one half percentage point over the most likely value (10.48% + 0.50% = 10.98%) which provided an increase of 40% in the proportion of students served in special education.

2) the economic variables--salaries and benefits, the cost/student in other agency programs, and inflation rate, where the high values previously developed were chosen for the high cost projections and the most likely values chosen for the low cost projections in order to reflect the current national economic and price level trends.

3) placement patterns, where a reversal of the previous low and high was selected. The more mainstreaming placement pattern was combined with the high incidence rate, to reflect the assumption that the increased number of students would be more mildly handicapped and go into mainstreaming placements. The current placement pattern was combined with the lower incidence rate since it was assumed that with fewer students in special education they will tend to be more seriously handicapped and their placement pattern will resemble the present pattern.

4) student/teacher ratios, where plus and minus 10% around the most likely values were selected for the high and low cost projections. The primary effect of this change was to eliminate the extreme differences between the most likely values and the alternative values were found in the previously developed values.

These combinations were used in SEPM to develop cost projections for the low alternative estimate and a high alternative estimate of the national costs of educating all school age handicapped students. These cost estimates are shown, together with the most likely cost estimates, in Table 16. Estimated costs range from a low estimate of $7.3 billion to a high estimate of $12.4 billion, a difference of $5.1 billion. While this

range is still substantial, it is considerably less than the $17.2 billion which would have resulted from cost estimates using all of the separate low or the high values in single projections without consideration of probable combinations of different values of the variables.

TABLE 16

RANGE OF ESTIMATES FOR SPECIAL EDUCATION COSTS
TO SERVE ALL SCHOOL AGE HANDICAPPED STUDENTS IN 1980-81
($ IN BILLIONS)

TYPE OF COST	LOW ALTERNATIVE	MOST LIKELY ESTIMATE	HIGH ALTERNATIVE
Instructional Programs	$5.761	$7.189	$10.113
Related Services	$1.534	$1.842	$ 2.239
Total Special Education Costs	$7.295	$9.031	$12.352

Policy Implications

There are two types of issues that come out of this study which are relevant for policymakers. The first group of issues concerns the policy uses of the results of the study and the second group of issues centers around the policy uses of the RCM methodology. Each will be discussed in turn.

Policy Uses of Results

The most likely cost projections indicate that approximately $9.0 billion would be required in 1980 if all school aged handicapped children were to receive an appropriate education. As a reference point, the comparable reported local, state, and federal special education costs in 1976-77 were $4.5 billion ($4.1 billion from state and local sources and $0.4 billion from federal sources).[16] While the projected figure is only an estimate, it does point out that a significant increase in funding would be required to reach the most likely service levels. However, the necessary cost increases for special education are likely to be even higher when a more complete utilization of related services is considered and when the costs for pre-school and postschool aged handicapped students are included.

Certainly one of the most important policy questions raised by these cost projections is from what sources will the potential $4.5 billion increase in funding come--local, state, federal? How much will each level have to provide and what will be the impact on the relative share of the funds provide by each? To show the range of possible outcomes, Table 17 illustrates three different alternatives under differing assumptions for federal participation. At one end of the range, P.L. 94-142 would be fully funded to its authorization level of $3.2 billion. The large federal increase would cover much of the increased funding requirements,

TABLE 17

ALTERNATIVE PROPORTIONS OF SPECIAL EDUCATION FUNDING
BY GOVERNMENTAL LEVEL

Alternative 1: Full Funding of P.L. 94-142

Governmental Level	Current		Addition	Future	
	$ billion	%	$ billion	$ billion	%
Local & State	$4.1	91%	$1.3	$5.4	60%
Federal	0.4	9%	3.2	3.6	40%
Total	$4.5	100%	$4.5	$9.0	100%

Alternative 2: Maintain FY 1981 Funding Level

Governmental Level	Current		Addition	Future	
	$ billion	%	$ billion	$ billion	%
Local & State	$4.1	91%	$3.9	$8.0	89%
Federal	0.4	9%	0.6	1.0	11%
Total	$4.5	100%	$4.5	$9.0	100%

Alternative 3: Equal Contribution for Additional Amount

Governmental Level	Current		Addition	Future	
	$ billion	%	$ billion	$ billion	%
Local & State	$4.1	91%	$2.2	$6.3	70%
Federal	0.4	9%	2.3	2.7	30%
Total	$4.5	100%	$4.5	$9.0	100%

although the local and state governments would still face a $1.3 billion increase. The federal share would rise to 40 percent from its 1976-77 share of 9 percent. At the other end of the range, the federal funding amount would remain at approximately the actual FY 1981 appropriation level. In this event, state and local sources would be required to fund an additional $3.9 billion, or almost double their 1976-77 amount. The middle alternative would be one in which the additional costs would be shared equally, with the local and state sources and the federal sources each funding an additional $2.3 billion. This would shift the state and local share to 70 percent and the federal share to 30 percent.

Associated with the program funding is often program control. Already, through new laws and regulations, there have been many shifts of program and fiscal control away from the local level to the state level and more recently away from the state level to the federal level. In this situation of increasing federal influence and control an important policy concern is the balance between the federal (and state) agencies' tasks of carrying out their legislated duties and the local districts' needs for flexibility in program implementation to meet individual circumstances. The situations found in different districts are too varied to establish a single national (or even state) set of detailed program standards to which all must conform.

The sensitivity analyses, also, provide useful information for policymakers. In estimating costs and, consequently, funding requirements, the choice of an incidence rate (or individual incidence rates for the various handicapping categories) is critical because, as shown, incidence rates are the major determinant of the projected costs. The wide range of incidence rates estimated by the states, as well as the statistical analyses performed on these data, confirmed what is

commonly known about incidence rate estimates; that is, they are primarily educated guesses and not scientifically derived from educational theory or research. As such, they are defined differently from state to state, and estimates for the same nominal categories may vary considerably. Furthermore, in addition to educational considerations, they are influenced by many political social and historical factors. Also, they are used for many other purposes in addition to estimating the number of unserved handicapped children and these other purposes -- lobbying for additional funds, building public support, projecting personnel needs -- may affect the magnitude of the estimated incidence rates. In sum, incidence rates should be viewed with caution, especially those which deviate substantially from actual counts of handicapped children. This is particularly true now, given the intensive efforts of locating, identifying, and assessing all handicapped children which have been undertaken in the states over the past few years. The $9.0 billion most likely cost estimate was predicated upon the assumption that 10.48% (most likely value) of the school age enrollments would receive some type of special education services. This assumed value represents an increase of approximately one million students or 26% over the most recent actual service level of 7.78%.[17] For policy purposes, it may be more useful to develop a rule of thumb for roughly estimating what the impact would be of specified increases over present service levels. This estimate could then apply to whatever increase in the number or proportion of students to be served was under consideration. Using the SEPM program and varying the incidence rates, the cost difference of one percentage point in the assumed incidence rate was calculated. It was found that raising the incidence rate from 7.78% to 8.78% (with all other variables kept at the most likely values) increased the projected costs by $708 million, the estimated number of students by 470,000, and the required number of teachers by 22,000.

The selection of the number of students per unit is also a policy decision with potentially significant implications for costs. This variable is very cost sensitive, particularly to a reduction of the number of students per unit. However, as this variable is usually specified in state regulations, it is also largely under the control of policymakers. Therefore, before initiating changes, in the student per unit regulations, policymakers may wish to estimate carefully the costs of the proposed changes.

A programmatic trend and legal requirement in special education is the placement of handicapped students in the least restrictive environment appropriate to their needs. The sensitivity analyses support this movement as cost-efficient for special education as well. In these analyses, the most likely placement patterns showed a shift of students toward the less restrictive settings. If the 1976-77 placement patterns had been maintained in 1980-81, there would have been an increase in the 1980-81 cost estimate of over $500 million as a result of greater proportions of students in more restrictive placements. These cost savings may be overstated to the extent that shifting students out of separate special education programs and into some (or substantial) participation in regular education would cause an increase in the costs of regular education. In general, however, the marginal cost savings in special education will outweigh the marginal cost increases in regular education. Further, the shifts of students to less restrictive placements within separate special education programs represent significant cost reduction possibilities, particularly if the number of students involved is large enough for the marginal cost savings per student to approach the average cost per student in these placements (i.e., from residential schools ($10,390/student) to day schools ($3,618/ student) to special classes

$1,755)). These results suggest that policymakers should reinforce the current least restrictive setting trend for cost reasons as well as programmatic ones. They indicate that by minimizing restrictive placements and encouraging less restrictive alternatives (subject to the needs of individual children), policymakers may have a substantial influence on special education costs.

In contrast, although teachers and aides salary and benefits levels were also shown to have a significant influence on special education costs, these items are most often tied to the general salary levels for all instructional personnel and, consequently, are largely out of direct control of special education. Therefore, while salary and benefit levels are certainly major policy issues, they are ones for all of education special education alone.

An important cost area in special education, about which little is known is related services. The incomplete state data base on which this study had to draw suggests that information on student needs and current practices is limited. The potential for large expenditures in this area exists since the cost impact of state and federal laws and regulations requiring related and support services to be provided to handicapped students is largely unknown. Additional research needs to be carried out to define what related services should be included, the extent of student needs for various related services, and the costs of related services. This is also an area with important inter-governmental and inter-agency cost implications. Greater federal support for handicapped students may be available through other program areas, such as Rehabilitation, Health, and Social Security, than through P.L. 94-142 appropriations which appear to have leveled off. Coordinating services from different social agencies, establishing the appropriate inter-agency agreements, and utilizing all available sources of

funding for handicapped children will become increasingly important as the pressure on educational budgets grows.

Policy Uses of the RCM Methodology

The RCM methodology utilized in this study to estimate the national costs of educating all school age handicapped children has a much wider applicability than this single use. It is not limited to special education. It can function as a useful tool in providing relevant information to policy-makers for a variety of purposes. The procedures of defining student populations to be served, establishing the programs and services to be offered, specifying the resources of each program, determining the student program assignments and student/teacher ratios can apply to other educational programs. Cost estimation in vocational education, compensatory education. and bilingual education can be conducted in the same manner only substituting the appropriate student classifications, programs, and decision rules for those of special education. Regular education can be specified by elementary and secondary, by grade level, or even by subject, and the costs estimated from student and program data and assumptions.[18] In each case, the RCM methodology is general enough to be appropriate for estimating the costs of the educational programs involved.

The RCM methodology can be used at all levels of government for planning and cost estimation purposes. At the federal level, it can serve as a macro planning tool to estimate the general magnitude of costs involved in various education programs. For example, the cost effects of proposed federal regulations associated with P.L. 94-142 could be modeled nationally with this methodology. Possible applications would include the individual education program requirement, due process proceedings, and various related services. However, to develop reliable cost estimates it

would be necessary to establish nationally applicable values of the programmatic and price variables in the model.

A brief example using psychotherapy services for emotionally disturbed students can serve to show both the process and the difficulties. First, it would be necessary to define what is meant by psychotherapy services (e.g., a single type of service provided by a specific professional, a range of different services provided by different types of personnel). Then, the resources for one unit of this (or these) psychotherapy service(s) must be specified along with their average national prices. Next, the numbers of emotionally disturbed students who will require psochotherapy services annually and the extent or duration of those services must be estimated. Also, the capacity of a unit of psychotherapy services (number of students which can be served by one unit) must be specified. These estimates and assumptions can then be combined through the RCM methodology to provide a projected national cost of the estimated type and level of psychotherapy services. The major problem faced in this process is establishing standard types of services, service levels, and service unit capacities that are valid across the nation. The variations in services (or lack of them) provided by school districts, in available resources and facilities, and in eligibility and placement practices may well limit the specification to the most general level. Nevertheless, the process does make it possible to develop national cost estimates. Further, it can identify areas where missing or incomplete data could be collected and the accuracy of the projections improved.

At the state level, the RCM methodology can also function as a planning tool to estimate educational program costs. However, since the state is a single jurisdiction with a single set of educational statutes amd regulations, uniformity in actual or desired program practices will be much more likely

than on the national level. (In fact, the SEPM used in this study was originally developed as a state planning model.) The RCM methodology can serve as a basis for many state level analyses including program cost estimation, budget preparation, and special cost studies. State funding of categorical and/or regular educational programs can also be accomplished through this approach.[19] (SEPM has been utilized to replicate the various special education funding formulas in use by states.)

Another important policy use of the methodology is the ability to test the effects on costs, personnel, and students of proposed new legislation or regulations which may cause changes in existing educational practices. Programmatic changes or changes in the methods or amounts of state aid to districts can be translated into terms of variables in the RCM methodology, and sensitivity analyses can be conducted to investigate the possible outcomes of the changes. The principal advantage of this procedure is that these activities can be carried out prior to passing legislation or finalizing regulations. If any undesirable effects are uncovered, it is possible to make appropriate modifications before statewide implementation. For example, a new bill to require annual psychiatric evaluation of all emotionally disturbed students may be motivated by the best intentions. However, if it would require twice as many psychiatrists as currently are in the state and it would increase the total special education budget by 20% for this single service, perhaps the intent of the legislation could be accomplished in a more feasible manner (e.g., annual evaluations for only emotionally disturbed children in separate educational settings and/or allowing the evaluations also to be done by trained personnel other than psychiatrists). In this case, the modified programmatic changes would be utilized in the RCM and new projections of costs and personnel obtained to examine their feasibility.

In a similar fashion, the ability to evaluate cost tradeoffs among different program practices is enhanced with the RCM methodology. Changes which would increase costs can be counterbalanced by other changes which would reduce costs and the net effect of several related programmatic changes can be calculated. For example, a greater use of instructional aides (cost increase) in certain programs could be combined with higher numbers of students per unit (cost reduction) in those programs.

As an illustration, two programs which have aides, resource room and special class, increase the use of aides from part-time to full-time in each program, while at the same time the number of students served by one unit of each program is increased by 10 students in the resource room and by 5 students in the special class. All other conditions remain constant. The impact of these changes on the most likely cost projections are shown in Table 18. Under these example conditions, the increase in aides alone would represent an additional cost of $650 million, however, the higher number of students per unit alone would reduce the costs by $939 million, and the interaction effect of the two variables (the fewer number of program units required due to the higher student/teacher ratios costed at the higher unit cost with aides) would cause a reduction of $186 million. The result would be a net cost reduction of $475 million for this example. Additionally, if the student outcomes (i.e., program effectiveness) of the original and alternative program practices were known or could be estimated, then the results of the RCM cost estimation could be used as the cost portion of a cost-effectiveness analysis.

Another type of tradeoff deals with establishing priorities among competing program proposals to meet budgetary limitations. By focusing on the programmatic aspects of the proposals and using the resource-cost

TABLE 18

EXAMPLE OF COST TRADEOFFS BETWEEN PROGRAM CHANGES:
GREATER USE OF INSTRUCTIONAL AIDES AND HIGHER STUDENTS PER UNIT IN TWO PROGRAMS

Program	Aides/Unit			Students/Unit			Interaction Effect ($ million)	Net Cost Difference ($ million)
	Most Likely	High Alternative	Cost Difference ($ million)	Most Likely	Low Alternative	Cost Difference ($ million)		
Resource Room	0.33	1.00	$307	22	32	($390)	($ 95)	($178)
Special Class	0.51	1.00	$343	11	16	($549)	($ 91)	($297)
Total			$650			($939)	($186)	($475)

model to translate program considerations into costs, this approach provides essential information to decision makers for choosing among different proposals and for making compromises among them. For example, would it be more important to lower the number of students per unit in special classes by an average of three students per class or to provide supplemental speech and language instruction to students in those classes? Both may be worthy objectives, but budget limitations may not permit both proposals. Analysis of such proposals through a resource-cost model will not answer the question of which proposal is more important, but it will provide an estimate of the costs of each proposal to aid in the decision. Further analysis can be conducted to determine programmatic compromises which could be made to achieve a portion of the objectives of each proposal and still remain within budget requirements. In the example above, this could mean lowering the average class size in special classes by one instead of three and providing speech and language instruction to only half of these students. In any such tradeoff analyses, however, care should be taken not to allow cost considerations to override good programming practices.

Uses of the RCM methodology at the local school district level are similar to those at the state level--program planning, analysis of program changes, comparison of alternatives, cost-effectiveness. In fact, the RCM methodology can be applied at the school level or for a single program within a district. However, more detail and precision would be required for district uses, such as budget preparation, than for state planning purposes. Fortunately, this is often the case since district records can provide actual numbers of students, actual program placements, actual salary schedules, actual student/teacher ratios instead of the estimated statewide averages which would be used at the state level.

One final aspect of the policy usefulness of the RCM approach is that it focuses attention on control points in the educational process. These are specific areas in which policymakers may intervene and have a direct influence on the programs' effects on students and on the program costs. For special education the areas over which educational decision makers have some control or influence include broad or narrow definition of handicapping conditions, resources utilized by various programs, placement of handicapped students in various instructional programs and related services, and numbers of students per unit of instructional programs. The degree of control will probably be greatest at the local level where the operating decisions are made; however, program standards and regulations promulgated at the state and federal levels can limit or direct local actions and provide the state and federal levels a means of controlling and/or influencing special education costs.

Summary and Conclusions

This study has used a particular cost estimation approach--a resource-cost model-- to estimate the costs of serving all school age handicapped students in the United States in 1980-81. The results indicate that the most likely cost estimate is $9.0 billion, but the range of probable costs was from $7.3 billion to $12.4 billion. This substantial variation was the result of differing assumptions concerning the number of handicapped students to be served, the placement patterns of students in instructional programs, the student/teacher ratio, the use of related services, and the price levels for resources.

There were certain difficulties in developing these national cost estimates. They stem principally from the problems in establishing student and program measures that accurately reflect national averages. As a result, the cost projections should be understood to provide an indication of the magnitude of the costs involved, but clearly are not precise.

The RCM methodology, however, has broad applicability, not only in special education, but for other categorical programs and regular education, as well. While this study has utilized the approach at the national level, it probably has greater usefulness at the state and local levels where a single set of laws, regulations, and standards are in force, where more uniformity in actual program practices exist, and where a greater level of detail is possible in student and program data. The methodology can be used for a variety of policy and analytical purposes including program planning, cost estimation, modeling of funding formulas, sensitivity analyses, testing of program or fiscal proposals before implementation, analysis of programmatic tradeoffs, and identification of critical control or intervention points for policymakers.

NOTES

1. For a comparison of different state laws and regulations governing special education, see State Profiles in Special Education, (Washington, D.C.: National Association of State Directors of Special Education, 1977).

2. A standardized chart of accounts to record educational expenditures is provided by National Center for Educational Statistics, Financial Accounting: Classifications and Standard Terminology for Local and State School Systems, State Educational Records and Reports Series: Handbook II, Revised (Washington, D.C.: Government Printing Office, 1973).

3. A Metz, N. Ford, and L. Silverman, Study of Excess Costs of Educating Handicapped Pupils, National Center for Educational Statistics, Report 75-223, DHEW (Washington, D.C.: Government Printing Office, 1975).

4. C. Bernstein, W. Hartman, M. Kirst, and R. Marshall, Financing Educational Services for the Handicapped: An Analysis of Current Research and Practices, (Reston, VA: Council for Exceptional Children, 1976), provides a review of special education cost studies.

5. R. Rossmiller, J. Hale, and L. Frohreich, Educational Programs for Exceptional Children: Resource Configurations and Costs, National Education Finance Project, Special Study No. 2 (Madison, WI: Department of Educational Administration, University of Wisconsin, 1970).

6. J. Kakalik, et al., Services for Handicapped Youth: A Program Overview, Report R-1220-HEW (Santa Monica, CA: Rand Corp, 1973).

7. J. Stultz, "The Incidence of Educational Needs and the Cost of Meeting These Needs in the United States in 1980," Journal of Education Finance 1 (Winter 1976): 361-72.

8. W. Hartman, "Estimating the Costs of Educating Handicapped Children: A Resource - Cost Model Approach - Summary Report," Educational Evaluation and Policy Analysis, forthcoming.

9. For a description of SEPM and its uses, see P. Hartman, et al., Special Education Planning Model: User Guide (Palo Alto, CA: MAC, Inc., 1978).

10. W.V. Grant and C.G. Lund, Digest of Educational Statistics: 1975 Edition, National Center for Educational Statistics, Report 76-211 (Washington, D.C.: Government Printing Office, 1976), p.38.

11. W. Hartman, "Estimating the Costs of Educating Handicapped Children".

12. J. Mack, J. Barresi, and J. Bunte, "Special Education Class Sizes" (Reston, VA: Policy Research Center, Council for Exceptional Children, March, 1980).

13. National Education Association, Estimates of School Statistics 1979-80 (Washington, D.C.: National Education Association, 1980), p.16.

14. Ibid.

15. P. Hartman, "User Guide," provides a thorough listing of related services.

16. W. Hartman, Estimating the Costs of Educating Handicapped Children: A Resource-Cost Model Approach (Washington, D.C.: U.S. Office of Education, Bureau of Education for the Handicapped, 1979), p. 96.

17. Progress Toward a Free Appropriate Public Education: A Report to Congress on the Implementation of Public Law 94-142: The Education for All Handicapped Children Act (Washington, D.C.: U.S. Office of Education, Bureau of Education for the Handicapped, January 1979), p. 162. The percentage of school-aged children served was adjusted for the total school age enrollments used in this study.

18. For examples of the resource-cost model approach applied in other educational settings, see S. Barro, "Modeling Resource Utilization in a School District," in Program Budgeting for School District Planning: Concepts and Applications, RM-616-RC, ed. S. Haggart, et al. (Santa Monica, CA: Rand Corp., 1969) and W. Curtis, Educational Resources Management System (Chicago: Research Corporation of the Association of School Business Officials, 1971).

19. J. Chambers and W. Hartman, "A Cost-Based Approach to the Funding of Educational Programs: An Application to Special Education" (Stanford, CA: Institute for Research on Educational Finance and Governance, 1980).

APPENDIX

Supplemental Projections
Students and Personnel
(Most Likely Case)

TABLE A-1

PROJECTED NUMBER OF STUDENTS
BY HANDICAPPING CATEGORY
(UNDUPLICATED COUNT)

CLASSIFICATION CATEGORIES		YEAR				
		76-77	77-78	78-79	79-80	80-81
EMR	NUMBER OF STUDENTS SERVED	761429	766497	778779	801649	836709
EMR	PERCENT OF STUDENTS SERVED	85	87	90	94	100
EMR	NUMBER OF STUDENTS UNSERVED	131534	117145	89532	50191	0
TMR	NUMBER OF STUDENTS SERVED	202405	199791	195339	190184	184908
TMR	PERCENT OF STUDENTS SERVED	103	102	102	101	100
TMR	NUMBER OF STUDENTS UNSERVED	-5065	-4511	-3447	-1932	0
HEARING	NUMBER OF STUDENTS SERVED	91366	95529	103927	116751	134058
HEARING	PERCENT OF STUDENTS SERVED	64	67	75	86	100
HEARING	NUMBER OF STUDENTS UNSERVED	51705	46049	35195	19730	0
SPEECH	NUMBER OF STUDENTS SERVED	1341152	1368235	1425240	1517020	1645680
SPEECH	PERCENT OF STUDENTS SERVED	76	79	83	91	100
SPEECH	NUMBER OF STUDENTS UNSERVED	415173	369756	282598	158422	0
VISION	NUMBER OF STUDENTS SERVED	40166	40654	41732	43564	46227
VISION	PERCENT OF STUDENTS SERVED	81	83	87	93	100
VISION	NUMBER OF STUDENTS UNSERVED	9169	8166	6241	3499	0
SED	NUMBER OF STUDENTS SERVED	294461	312533	348669	403210	476138
SED	PERCENT OF STUDENTS SERVED	58	62	71	83	100
SED	NUMBER OF STUDENTS UNSERVED	213689	190313	145453	81539	0
ORTHO	NUMBER OF STUDENTS SERVED	88623	88692	89107	90292	92454
ORTHO	PERCENT OF STUDENTS SERVED	90	91	93	96	100
ORTHO	NUMBER OF STUDENTS UNSERVED	10047	8948	6839	3834	0
OHI	NUMBER OF STUDENTS SERVED	134173	137070	143139	152854	166417
OHI	PERCENT OF STUDENTS SERVED	76	78	83	90	100
OHI	NUMBER OF STUDENTS UNSERVED	43433	38682	29564	16573	0
SLD	NUMBER OF STUDENTS SERVED	818203	853678	925365	1035097	1183411
SLD	PERCENT OF STUDENTS SERVED	65	68	75	86	100
SLD	NUMBER OF STUDENTS UNSERVED	444769	396114	302743	169715	0
MULTIPLE	NUMBER OF STUDENTS SERVED	65401	66546	68983	72960	78586
MULTIPLE	PERCENT OF STUDENTS SERVED	78	80	85	91	100
MULTIPLE	NUMBER OF STUDENTS UNSERVED	18468	16448	12571	7047	0
TOTAL	NUMBER OF STUDENTS SERVED	3837382	3929225	4120280	4423583	4844588
TOTAL	PERCENT OF STUDENTS SERVED	74	77	82	90	100
TOTAL	NUMBER OF STUDENTS UNSERVED	1333159	1187343	907517	508842	0

TABLE A-2

PROJECTED NUMBERS OF STUDENTS
BY INSTRUCTIONAL PROGRAMS
(DUPLICATED COUNT)

TYPE OF PROGRAM	YEAR				
	76-77	77-78	78-79	79-80	80-81
INDIRECT SERVICES	100606	106150	117668	136078	162497
SPEECH & LANGUAGE INSTR.	1421400	1455248	1526295	1640548	1801715
OTHER DIRECT SERVICES	138553	149353	172449	210947	269181
RESOURCE ROOM	1025540	1069657	1161052	1306247	1511980
SPECIAL CLASS	1126467	1133472	1147279	1166436	1184016
OTHER AGENCY DAY SCHOOL	74141	78439	87477	102171	123707
RESIDENTIAL SCHOOL	107626	106236	103140	97566	87830
HOSPITAL & HOMEBOUND	57822	60871	67472	78627	95653
TOTAL	4052155	4159426	4382832	4738620	5236579

TABLE A-3

PROJECTED NUMBER OF INSTRUCTIONAL
PERSONNEL SERVING EACH HANDICAPPED CATEGORY

CLASSIFICATION	YEAR				
	76-77	77-78	78-79	79-80	80-81
EMR					
CERTIFIED	45769	46003	46596	47743	49523
NON-CERTIFIED	20282	20280	20326	20492	20788
TMR					
CERTIFIED	15523	15372	15129	14872	14645
NON-CERTIFIED	7582	7503	7372	7231	7100
HEARING					
CERTIFIED	6419	6606	6957	7433	7946
NON-CERTIFIED	2266	2310	2385	2465	2501
SPEECH					
CERTIFIED	22666	23023	23772	24967	26601
NON-CERTIFIED	1490	1461	1397	1288	1110
VISION					
CERTIFIED	3119	3158	3249	3400	3620
NON-CERTIFIED	954	968	999	1051	1127
SED					
CERTIFIED	21702	22957	25436	29111	33901
NON-CERTIFIED	9436	9873	10699	11824	13099
ORTHO					
CERTIFIED	7031	7059	7135	7294	7557
NON-CERTIFIED	1647	1646	1649	1662	1692
OHI					
CERTIFIED	10994	11243	11769	12611	13792
NON-CERTIFIED	3507	3516	3531	3549	3540
SLD					
CERTIFIED	39809	41567	45124	50589	58011
NON-CERTIFIED	14459	15030	16171	17885	20140
MULTIPLE					
CERTIFIED	6178	6363	6759	7404	8344
NON-CERTIFIED	3032	3119	3303	3604	4042
TOTAL					
CERTIFIED	179210	183351	191926	205424	223940
NON-CERTIFIED	64655	65706	67832	71051	75139

TABLE A-4

PROJECTED NUMBER OF INSTRUCTIONAL PERSONNEL
BY INSTRUCTIONAL PROGRAM

TYPE OF PROGRAM	YEAR				
	76-77	77-78	78-79	79-80	80-81
INDIRECT SERVICES					
CERTIFIED	1281	1352	1502	1740	2079
NON-CERTIFIED	0	0	0	0	0
SPEECH & LANGUAGE INSTR.					
CERTIFIED	21247	21754	22816	24525	26935
NON-CERTIFIED	0	0	0	0	0
OTHER DIRECT SERVICES					
CERTIFIED	5435	5828	6673	8088	10235
NON-CERTIFIED	0	0	0	0	0
RESOURCE ROOM					
CERTIFIED	45691	47677	51800	58365	67705
NON-CERTIFIED	15078	15734	17095	19261	22342
SPECIAL CLASS					
CERTIFIED	97229	98004	99508	101569	103535
NON-CERTIFIED	49587	49982	50750	51800	52802
OTHER AGENCY DAY SCHOOL					
CERTIFIED	0	0	0	0	0
NON-CERTIFIED	0	0	0	0	0
RESIDENTIAL SCHOOL					
CERTIFIED	0	0	0	0	0
NON-CERTIFIED	0	0	0	0	0
HOSPITAL & HOMEBOUND					
CERTIFIED	8327	8736	9627	11137	13451
NON-CERTIFIED	0	0	0	0	0
TOTAL					
CERTIFIED	179210	183351	191926	205424	223940
NON-CERTIFIED	64665	65716	67845	71061	75144